

## **The accent of Korean native nouns: North Gyeongsang compared to South Gyeongsang**

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**Son, Jae-Hyun and Ito, Chiyuki. 2016. The accent of Korean native nouns: North Gyeongsang compared to South Gyeongsang.** *Studies in Phonetics, Phonology and Morphology* 22.3. 499-532. This paper examines the accent of native simplex nouns in North Gyeongsang Korean with a comparison to South Gyeongsang. It is assumed that both the North and South Gyeongsang dialects originate from the same source language, and in fact their accent systems are very similar. However, there are a few differences in their accent systems, which are due to different historical developments from Proto-Gyeongsang. Based on a detailed examination of the data, we demonstrate that small differences in the accentual systems as well as on-going tonal mergers in each dialect have led the two Korean dialects to have different association patterns between accent classes and segmental types/syllable weight: the expansion of the syllable weight effect in the initial syllable in North Gyeongsang vs. the generalization of aspirated/tense onset effect in South Gyeongsang. (Duksung Women's University and Tokyo University of Foreign Studies)

Keywords: accent, segmental type, syllable weight, North and South Gyeongsang Korean

### **1. Introduction**

Accents in the Korean Gyeongsang dialect have been explored in many previous studies (Cen 1966a, b, 1967, Rah 1974, C-K. Kim 1993, 1994a, 1994b, Kenstowicz and Sohn 2001, Son 2007, H-J. Kim 2012 for North Gyeongsang and He 1955, Hankwuk cengsin munhwa yenkwuwen 1993, C-K. Kim 2002, Kang 2005, 2008, Son 2007, Kim et al. 2008, D-M. Lee 2009 for South Gyeongsang). Gyeongsang accentuation has been documented and analyzed in a number of contexts, such as basic accent systems, compound accentuation, tonal alternation in verbal inflection, and loanword accent patterns. Still, few studies have systematically examined accent

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distributions and their correlations with segmental types or syllable weights based on a relatively large corpus. Most such studies focus on loanword accentuation. For example, Kenstowicz and Sohn (2001) analyzed loanword accentuation in North Gyeongsang Korean and found that syllable weight affects accent patterns. They hypothesized that the default Universal Grammar setting for syllable weight determines the loanword accent patterns. H-K. Jun (2006) and D-M. Lee (2006) found a similar tendency in South Gyeongsang loanword accentuation. Related to Kenstowicz and Sohn (2001), H-J. Kim (2012) examined factors affecting the accents of novel words by investigating the accent patterns of native simplex disyllabic/trisyllabic nouns in North Gyeongsang. She found that the accents of novel words reflect statistical associations in the lexicon between accent and heavy syllables, though this association was stronger in novel words than in existing words. Do et al. (2014) conducted a similar study, examining the accents of native simplex nouns of South Gyeongsang Korean with regard to stem structure. They also showed historical correspondences between South Gyeongsang and Middle Korean (15-16th c., MK) and clarified the tendencies observed in historical/analogical contexts. They conducted novel word experiments and speculated that the accents of novel words are computed from a default grammar that applies productively to trisyllabic lexicons.

In this paper, we examine the accents of native simplex nouns in North Gyeongsang Korean through comparisons to South Gyeongsang, as reported by Do et al. (2014). It is assumed that the North and South Gyeongsang dialects originated from the same source language (Proto-Gyeongsang), and their accent systems are in fact very similar, with a few exceptions, due to regular historical developments from their proto-language. Based on a detailed examination of the data, we demonstrate that small differences in the accentual systems and on-going tonal mergers in each dialect have led the two Korean dialects to have different association patterns between accent classes and segmental types/syllable weights.

This paper is organized as follows. Sections 2-4 outline the materials used, the accent systems of both North and South Gyeongsang dialects, and the accent agreement rates among speakers. Sections 5-7 examine the accentual distributions in monosyllabic/disyllabic/trisyllabic native simplex nouns in North Gyeongsang and describe the differences between North and South Gyeongsang. Section 8 summarizes our comparisons between North and South Gyeongsang accents.

## 2. Materials

The data used in this study are composed of 2,000 native simplex nouns (427 monosyllabic nouns, 1014 disyllabic nouns, and 559 trisyllabic nouns, including some nouns nativized from Sino-Korean nouns<sup>2</sup>). The data were collected from five North Gyeongsang native speakers (NK1: female born in 1932, NK2: female born in 1947, NK 3: male born in 1960, NK 4: female born in 1971, NK 5: male born in 1988), one of whom is the first author of this study. The data collection was conducted through interviews by the first author in Daegu, North Gyeongsang, in September 2014. Consultants pronounced each word from the list in inflected forms (nominative/ accusative forms), and their accent patterns were documented. There were 8,040 total datapoints, a number less than 10,000 ( $= 2,000 * 5$ ) since all of the speakers did not report using all of the words investigated in this study.

In parallel with Do et al. (2014), we investigated historical correspondences between Middle Korean (15th-16th c., MK) and North Gyeongsang. There has been a controversy in the literature about the relationship between the Gyeongsang dialect, Middle Korean (also the Hamgyeong dialect in North Korea) and Proto-Korean with regard to accent: i.e. which type of accent system is the precedent of the others and how each accent system emerged (Hayata 1976, Ramsey 1978, Uwano 2012, Fukui 2013, Ito 2013). However, given the fact that the accent of both North and South Gyeongsang dialects shows regular correspondences with MK as discussed below, it is reasonable to compare the two Gyeongsang dialects using the MK data as a reference point. See the literature cited above for detailed discussion of the historical development of accent in various Korean dialects. In this paper, we assume that the Gyeongsang dialect (and the pre-Gyeongsang dialect) has emerged from a kind of MK-type accent system as a result of a leftward accent shift.

The MK form (if known) was taken from a database derived from the analysis of over 30 MK texts by the second author (Ito 2013).

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<sup>2</sup> Nativized Sino-Korean words are distinguished from “genuine” Sino-Korean words because the former do not correspond with their underlying Sino-Korean morpheme pronunciations. E.g., *həm* ‘flaw’ (cf. 欠 *him*), *kwaj* ‘storeroom’ (cf. 庫房 *ko.paj*)

### 3. Accent system

Table 1 summarizes the accent systems of North and South Gyeongsang dialects. The parentheses indicate tonal patterns of a following suffix. Right-hand columns show examples of each accent class. In these examples, a high tone is indicated with an acute accent, while a low tone is indicated by lack of accent mark. The same notation is used in the other examples of this paper as well. The double-high accent classes, H(H) and LH(H), are indicated as  $\acute{\sigma}$  and  $\acute{\sigma}\acute{\sigma}$ , respectively. The South Gyeongsang L(H) class is indicated as  $\sigma$  since it appears as a rise in isolation forms. In the discussion below, we abbreviate the tonal patterns of a suffix to indicate each accent class, except for monosyllabic nouns and the LH(L) and LH(H) classes of South Gyeongsang.

North and South Gyeongsang have similar accent systems with only limited differences. First, North Gyeongsang distinguishes long vs. short vowels, and the long vowel can appear only in the first syllable of a phonological word<sup>3</sup>. When the initial syllable contains a long vowel, the word always belongs to the initial-double H class (H:(H), H:H, and H:HL)<sup>4</sup>. In South Gyeongsang, this long vowel series corresponds with the L(H), LH(H), and LHH tonal patterns, respectively—an observation confirmed by comparisons with historical sources. As mentioned above, the South Gyeongsang L(H) class appears as a rise in isolation (citation) forms. Second, in South Gyeongsang, a sequence of low tones at the left edge of the word is prohibited; hence, the LLH class observed in North Gyeongsang does not appear in South Gyeongsang. It is hypothesized that the LLH class existed in pre-South Gyeongsang dialects, but merged with LHH by leftward spreading of the H tone<sup>5</sup>. Due to this merger, four accent classes are contrasted in South Gyeongsang trisyllabic nouns, while five accent classes are distinguished in North Gyeongsang trisyllabic nouns.

<sup>3</sup> Loanwords may represent exceptions for this positional restriction, as in *ki.rá:m* ‘gram.’

<sup>4</sup> There are some exceptions in loanwords: e.g., *i:.kil* ‘eagle’, *c<sup>h</sup>i:.ci* ‘cheese.’

<sup>5</sup> Co (2000) reports that the South Gyeongsang Changnyeng dialect has the LLH class, which corresponds with the LHH class of South Gyeongsang Pusan dialect.

**Table 1. Accent systems of the North and South Gyeongsang dialects.**

North Gyeongsang				Examples		
σ	1	2	3	1	2	3
	H(H)	HH(L)	HHL(L)	mũl 'water'	kú.rám 'cloud'	mú.cí.kε 'rainbow'
	H(L)	HL(L)	HLL(L)	mók 'neck'	má.nil 'garlic'	mjə.ni.ri 'daughter-in-law'
	H:(H)	LH(L)	LHL(L)	mǎ:l 'language'	pa.rám 'wind'	mi.ná.ri 'parsley'
		H:H(L)	LLH(L)		sá:.rám 'man'	pok.suŋ.á 'peach'
			H:HL(L)			ə:.rí.sin 'esteemed elder'
South Gyeongsang				Examples		
σ	1	2	3	1	2	3
	H(H)	HH(L)	HHL(L)	mũl 'water'	kú.rám 'cloud'	mú.cí.kε 'rainbow'
	H(L)	HL(L)	HLL(L)	mók 'neck'	má.nil 'garlic'	mjə.ni.ri 'daughter-in-law'
	L(H)	LH(L)	LHL(L)	mǎl 'language'	pa.rám 'wind'	mi.ná.ri 'parsley'
		LH(H)	LHH(L)		sa.rám 'man'	pok.suŋ.á 'peach'
						ə:.rí.sin 'esteemed elder'

Although vowel length is distinctive in North Gyeongsang, some speakers (in particular younger speakers) have lost the distinction completely. The five consultants in this study retain the length distinction, but some words show mergers from the long vowel classes to the double-H classes (H(H), HH, HHL), reflecting the general sound changes in progress in this dialect.

Table 2 shows the accent patterns observed in Middle Korean (MK) nouns. L, H, and R indicate low, high, and rising, respectively. R is hypothesized to be composed of L + H (Kōno 1945). In MK, the first high pitch is distinctive, and the tonal contour after the first H is predictable depending on the number of following syllables in the same phonological phrase (Ceng 1971, W-C. Kim 1973, Kadowaki 1976, Ramsey 1978, Fukui 1985). These predicted tonal patterns after the first H are notated as "X" in this paper.

**Table 2. MK accents.** In MK examples, a high tone is indicated with an acute accent, whereas a low tone is indicated with a grave accent. A rising tone is indicated with both accents (ˊˋ). Syllables with accents that are unspecified are shown without tonal marks.

σ	1	2	3	1	2	3
	H	HX	HXX	míl	kú.rum	mí.ci.kəj
				‘water’	‘cloud’	‘rainbow’
	L	LH	LHX	mòk	mà.nál	mjà.ní.ri
				‘neck’	‘garlic’	‘daughter-in-law’
	R	LL	LLH	mál	pà.rám	mì.nà.rí
				‘language’	‘wind’	‘parsley’
		RX	LLL		sǎ.rám	pòk.sjàŋ.hwà
					‘man’	‘peach’
			RXX			ǎl.u.sin
						‘esteemed elder’

Regular correspondences between MK and North/South Gyeongsang are shown in Table 3. In general, a leftward shift of an H tone is observed in Gyeongsang, along with an insertion of an L tone after the shifted H tone: e.g., MK LH > Gyeongsang HL, MK LHX > Gyeongsang HLL<sup>6</sup>. The MK H-initial classes correspond with the double-H class in Gyeongsang: e.g., MK HX > Gyeongsang HH. The major difference between North and South Gyeongsang is the reflex of the MK R-initial classes: MK R > North Gyeongsang H:(H) vs. South Gyeongsang L(H), MK RX > North Gyeongsang H:H vs. South Gyeongsang LH(H). In the former, the MK H and R-initial classes are distinguished solely by length, whereas in the latter, the original rising tone was decomposed to a LH tone, after which H doubling was applied. In addition, due to the leftward spreading in South Gyeongsang noted above, both MK LLL and RXX classes correspond with the South Gyeongsang LHH class, while they are distinguished in North Gyeongsang: MK LLL > North Gyeongsang LLH, MK RXX > North Gyeongsang H:HL.

<sup>6</sup> As mentioned above, there is controversy concerning the direction of the historical accent shift (leftward vs. rightward).

**Table 3. Regular correspondences between MK and North Gyeongsang (NK)/South Gyeongsang (SK)**

MK	NK	SK	MK	NK	SK	MK	NK	SK
H	H(H)	H(H)	HX	HH	HH	HXX	HHL	HHL
L	H(L)	H(L)	LH	HL	HL	LHX	HLL	HLL
R	H:(H)	L(H)	LL	LH(L)	LH(L)	LLH	LHL	LHL
			RX	H:H	LH(H)	LLL	LLH	LHH
						RXX	H:HL	LHH

In MK, the final accent classes (H, LH, LLH) are the largest/default accent class (Ramsey 1978, Ito 2013). This suggests that, in Gyeongsang, the H(H) class and the penultimate accent classes (HL, LHL) are the predominant accent classes, which is confirmed in the discussion below.

#### 4. Agreement rates

Table 4 shows the accent agreement rates among the five North Gyeongsang speakers, calculated for monosyllabic, disyllabic, and trisyllabic nouns. “Agree” indicates words in which all five speakers assigned the same accent class. “Disagree” indicates words in which at least one speaker assigned a different class compared to the other speakers. The agreement rates are high for all cases. Compared to North Gyeongsang, the agreement rates of the five South Gyeongsang speakers reported by Do et al. (2014) are lower: 67% (monosyllabic), 59% (disyllabic), 74% (trisyllabic).

**Table 4. Accent agreement rates among five speakers**

	Monosyllable	Disyllable	Trisyllable
Agree	261	530	246
Disagree	52	98	43
Agreement rate	83%	84%	85%

##### (1) Examples

- a. monosyllable, agree: píc<sup>h</sup> ‘light’, jǒs ‘candy’, píç ‘debt’, pat<sup>h</sup> ‘field’, kǎ: ‘dog’, sǎ: ‘bird’
- b. monosyllable, disagree: cǎs~cǎ:s ‘pine nuts’, kǔs~kús ‘exorcism’, mǎ:~mé ‘hawk’
- c. disyllable, agree: á.kí ‘baby’, pón.ké ‘lightning’, á.i ‘child’, ká.sim ‘breast’, a.c<sup>h</sup>ím ‘morning’, pi.njǎ ‘hairpin’, á:n.ké ‘fog’, pá:.pó ‘fool’

- d. disyllable, disagree: təm.púl~təm.pul ‘bush’, twi.cú~twí:.cú ‘rice chest’, á.né~á.né ‘wife’, ká.ma~ká:.má ‘kettle’
- e. trisyllable, agree: kí.rím.ca ‘shadow’, sóŋ.sá.ri ‘minnow’, á.hi.re ‘nine days’, á.ci.me ‘aunty’, a.pó.ci ‘father’, ta.sí.ma ‘sea tangle’, o.ri.mák ‘uprise’, pok.suŋ.á ‘peach’, má:.nú.ra ‘wife’, sá:.má.kwi ‘praying mantis’
- f. trisyllable, disagree: á:.rí.sin~á.rí.sin ‘esteemed elder’, i.já.ki~í.já.ki ‘conversation’, ká.o.ri~ka.ó.ri ‘ray’, kí:.cí.ke~ki.cí.ke ‘stretching’, mu.rú.p<sup>h</sup>ak~mu.ru.p<sup>h</sup>ák ‘knee’

In the following sections, we examine accent distributions of monosyllabic/disyllabic/trisyllabic native simplex nouns in North Gyeongsang with comparisons to the same in South Gyeongsang. South Gyeongsang data are based on Do et al. (2014).

## 5. Monosyllabic nouns

In this section, we discuss the accent distribution of monosyllabic native nouns in North Gyeongsang based on five factors: speaker differences, correspondences with MK, token frequency, speaker age, and onset/coda types.

### 5.1 Speaker differences

Table 5 shows the accent distributions of monosyllabic nouns for each speaker. In general, all speakers show similar distributional patterns. As a whole, the H(H) class is the largest class (59%), followed by the H(L) class (25%) and the H:(H) class (16%). South Gyeongsang shows similar distributional patterns (H(H) = 53%, H(L) = 26%, L(H) = 21%), but the ratio of H:(H) (16%) is lower in North Gyeongsang than in South Gyeongsang L(H) (21%), reflecting the merger/loss of long vowels mentioned above (H:(H) > H(H)).

**Table 5. Speaker differences and accent distributions (monosyllabic)**

speaker accent class	N1	N2	N3	N4	N5	Totals	Ratio
H(H)	219	216	223	211	219	1088	59%
H(L)	97	95	103	81	80	456	25%
H:(H)	66	69	67	61	38	301	16%
Totals	382	380	393	353	337	1845	



## 5.2 Correspondences with MK accents

Table 6 shows correspondences with MK accent classes. The regular correspondences between MK and North Gyeongsang are: MK H > North Gyeongsang H(H), MK L > North Gyeongsang H(L), MK R > North Gyeongsang H:(H). The shaded cells indicate regular correspondences.

**Table 6. Correspondences between MK and North Gyeongsang (monosyllabic)**

<div style="display: inline-block; transform: rotate(-45deg); font-size: 0.8em;">MK \ NK</div>	H(H)	H(L)	H:(H)	Totals	H(H)%	H(L)%	H:(H)%
H	708	41	23	772	92%	5%	3%
L	41	248	1	290	14%	86%	0%
R	56	16	172	244	23%	7%	70%

## (2) Examples of regular correspondences

- a. MK H: ǎn ‘inside’, ős ‘clothes’, hjǎ ‘tongue’, pǎ ‘boat’, mǎs ‘nail’
- b. MK L: cíp ‘house’, pé ‘pear’, súc<sup>h</sup> ‘charcoal’, mít<sup>h</sup> ‘bottom’, náks ‘soul’
- c. MK R: twí: ‘back’, só:k ‘inside’, pá:m ‘chestnut’, kǎm ‘bear’, sú:m ‘breath’

The regularity rate is highest in the MK H class (92%), followed by the MK L class (86%) and the R class (70%). This is the same tendency as in South Gyeongsang, in which the regularity rates of the MK H, L, R classes are 83%, 70%, and 65%, respectively. Among irregular developments, more words moved from the MK L class to the North Gyeongsang H(H) class than from the MK H class to the North Gyeongsang H(L) class (14% vs. 5%), which is probably due to the higher type frequency of the H(H) class compared to the H(L) class in North Gyeongsang. This tendency with regard to the irregular development is observed in South Gyeongsang as well.

## 5.3 Token Frequency

In parallel to Do et al. (2014), we investigated the correlations between token frequency and regular correspondence with MK accents (Table 7). In addition to type frequency, token frequency is hypothesized to play a role in phonological change (Phillips 1984, 2006, Bybee 2001). Less frequent words are more susceptible to

analogical changes than highly frequent words, since learners have fewer opportunities to hear less frequent words in general. Token frequency is divided into high and low types based on the median value of token frequency in the King Sejong corpus (Kim and Kang 2000) of each monosyllabic noun. As expected, the token frequency effect is observed: high-frequency words tend to retain the MK accent class more than low-frequency words in all of the accent classes ( $\chi^2 = 23.0215$ ,  $df = 1$ ,  $p = 1.602e-06$ ). This is the same tendency as in South Gyeongsang.

**Table 7. Token frequency and accent**

MK \ NK	H(H)	H(L)	H:(H)	Totals	H(H)%	H(L)%	H:(H)%
H (Low)	312	31	18	361	86%	9%	5%
H (High)	375	10	2	387	97%	3%	1%
L (Low)	15	128	1	144	10%	89%	1%
L (High)	12	115	0	127	9%	91%	0%
R (Low)	28	13	58	99	28%	13%	59%
R (High)	28	1	96	125	22%	1%	77%

(3) Examples

- a. MK H (Low): kũl~ kũ:l ‘oyster’, kũs~kũs ‘exorcism’, kũp~ kũp ‘hoof’
- b. MK H (High): ăl ‘egg’, năc ‘daytime’, nŏn ‘rice field’, t<sup>h</sup>ĩm ‘crack’
- c. MK L (Low): cĩp<sup>h</sup>~ cĩp<sup>h</sup> ‘straw’, tŏc<sup>h</sup>~ tŏc<sup>h</sup> ‘sail’, t<sup>h</sup>ẽ ‘frame’
- d. MK L (High): áp<sup>h</sup> ‘front’, sũl ‘wine’, pát<sup>h</sup> ‘field’
- e. MK R (Low): sŏl ‘brush’, pŏs~ pŏs ‘friend’, cǎs~ cǎ:s ‘pine nuts’
- f. MK R (High): tŏ:n ‘money’, mǎ:l ‘language’, sě: ‘bird’

#### 5.4 Speaker age

Our North Gyeongsang consultants are from different generations. Table 8 below shows the regular correspondence rate with MK for each speaker. In general, the older the speaker, the more regular the correspondences, although the differences are relatively small. Still, a linear regression analysis with regularity rate as the dependent variable and speaker age as the independent variable shows significant results (estimate = -1.299e-03, std. error = 8.535e-05, t-value = -15.22,  $p = 0.000616$ ).

**Table 8. Speaker age and accent conservation**

	NK1 (1932)	NK2 (1947)	NK3 (1960)	NK4 (1971)	NK5 (1988)
Regular	235	231	230	199	189
Irregular	25	28	35	33	38
Totals	260	259	265	232	227
Regularity	90%	89%	87%	86%	83%

### 5.5 Onset and coda type

Finally, we examined whether correlations between segmental type and accent class are observed in North Gyeongsang monosyllabic nouns. Table 9 shows correlations between onset type and accent. In this table, words with a fricative onset were excluded, in parallel to Do et al. (2014). Aspirated/tense onsets are significantly less preferred by the H:(H) class, but overrepresented in the H(H) class. On the other hand, a lax onset shows the opposite tendency: it is overrepresented in the H:(H) class, whereas it is underrepresented in the H(H) class. The same result was obtained in South Gyeongsang. These differences in accent patterns between aspirated/tense onsets and lax onsets are due to the fact that the North Gyeongsang H:(H) class originates from the MK R (= L + H) class, whereas the North Gyeongsang H(H) class originates from the MK H class. We hypothesize that aspirated/tense onsets are less likely to be associated with a low-tone syllable.

**Table 9. Monosyllabic accent class with respect to onset (sonorant, lax, aspirated/tense). Left = observed numbers, right = observed/expected numbers. Statistically significant correlations ( $\alpha$ -level at 0.05) are in bold. These are cells in which Chi-square exceeds the 0.05 alpha level for the table as a whole and thus contribute most to the overall Chi-square statistic [ $\chi^2 = 78.9321$ ,  $df = 4$ ,  $p = 2.932e-16$ ].**

onset \ accent	H(H)	H(L)	H:(H)	Totals	H(H)	H(L)	H:(H)
Sonorant	276	119	62	457	0.97	1.10	0.97
Lax	339	153	136	628	<b>0.87</b>	1.03	<b>1.55</b>
Aspirated/Tense	379	105	25	509	<b>1.19</b>	0.87	<b>0.35</b>
Totals	994	377	223	1594			

## (4) Examples

- a. Sonorant: móm ‘body’, nŭn ‘eye’, mál ‘horse’, mók ‘neck’, mǎ:l ‘language’, nǎ:l ‘board’
- b. Lax: tǎm ‘fence’, cǎl ‘temple’, kúk ‘soup’, tǎc<sup>h</sup> ‘trap’, kǎ:m ‘persimmon’, kí:m ‘laver’
- c. Aspirated/Tense: c<sup>h</sup>ě ‘sieve’, k\*ě ‘sesame’, c\*ák ‘pair’, t<sup>h</sup>ól ‘fur’, c<sup>h</sup>ǎ:n ‘cloth’, t<sup>h</sup>ǎ:l ‘mask’

Table 10 shows the correlations between coda type and accent classes. Sonorant codas are overrepresented in the H:(H) class, while obstruent codas are underrepresented, although they are overrepresented in the H(L) class. Given that the H:(H) class was originally the rising class in MK, the association between sonorant codas and the H:(H) class is understandable, since sonorant codas can carry F0 pitch distinctions, which are difficult if not impossible to detect in obstruents. Some words changed accent class based on this correlation: e.g., *pəs* ‘friend’ H(H)~H(L) [< MK R]; *cis* ‘behavior’ H(H) [< MK R]; *hom* ‘groove’ H:(H) [< MK H], *p\*jam* ‘cheek’ H:(H) [< MK H]. South Gyeongsang shows similar distributions of coda type.

**Table 10. Monosyllabic accent class with respect to the coda (Ø, obstruent, sonorant) [ $\chi^2 = 162.5933$ ,  $df = 4$ ,  $p < 2.2e-16$ ].**

coda \ accent	H(H)	H(L)	H:(H)		H(H)	H(L)	H:(H)
Ø	314	100	75		1.09	0.83	0.94
Obstruent	270	209	21		0.92	<b>1.69</b>	<b>0.26</b>
Sonorant	505	147	205		1.00	<b>0.69</b>	<b>1.47</b>
Totals	1089	456	301				

## (5) Examples

- a. Ø: í ‘tooth’, k<sup>h</sup>ố ‘nose’, wí ‘upside’, kjǎ ‘chaff’, kě: ‘dog’, kě:~kě ‘crab’
- b. Obstruent: ǐp ‘mouth’, cǎc ‘breast’, nác<sup>h</sup> ‘face’, pák\* ‘outside’, sǎ:k ‘inside’, cǎ:s~cǎs ‘pine nuts’
- c. Sonorant: pǎm ‘spring’, sín ‘shoes’, hwál ‘bow’, tǐŋ ‘back’, pǎ:m ‘chestnut’, cǎ:ŋ ‘servant’

## 5.6 Summary

In order to assess the statistical significance of factors reviewed above, we fitted a mixed-effects log-linear regression model using the `glmer` function from the `lme4` package (Bates et al. 2014) in R (R Development Core Team 2011). For simplicity, we examine only the segmental factors here. The dependent variable was accent distribution of the three accent classes (H(H), H(L), H:(H)), and the baseline was set to H(H). The predictor variables were onset type (aspirated/tense, lax/sonorant) and coda type (vowel, sonorant, obstruent), and they were sum-coded. A random intercept was set for item and subject. The results appear in Table 11. All tendencies mentioned above are statistically significant: aspirated/tense onsets are negatively associated with the H(L) and H:(H) classes (= positive association between aspirated/tense onsets and the H(H) class); obstruent codas are positively associated with H(L) but biased against the H:(H) class, while a sonorant coda is positively associated with H:(H) but biased against the H(L) class.

**Table 11. Results of a mixed-effects log-linear regression model (monosyllabic lexicon)**

		Estimate	Std. Error	z value	Pr(> z )	
(Intercept)		-2.39852	0.04011	-59.8	< 2e-16	***
H(L) class:	Onset-Asp/Tns	-0.38532	0.08603	-4.48	7.50e-06	***
	Coda-Obs	0.79896	0.10353	7.72	1.19e-14	***
	Coda-Son	-0.51102	0.11563	-4.42	9.89e-06	***
H:(H) class:	Onset-Asp/Tns	-1.00374	0.16923	-5.93	3.01e-09	***
	Coda-Obs	-1.83264	0.39444	-4.65	3.38e-06	***
	Coda-Son	1.10020	0.21826	5.04	4.64e-07	***

## 6. Disyllabic nouns

### 6.1 Distribution

In this section, we examine the accent distribution patterns of simplex disyllabic native nouns. Table 12 shows the accent class distribution of each North Gyeongsang consultant. The consultants tend to show similar patterns, except for N5 (the

youngest speaker), whose ratio for the H:H class is relatively lower. The overall distributional patterns are similar between North and South Gyeongsang, although the ratio of H:H (= South Gyeongsang LH(H)) is lower in North Gyeongsang: HL (41%) > LH (31%) > HH (20%) > H:H (8%) in North Gyeongsang vs. HL (42%) > LH(L) (28%) > HH (18%) > LH(H) (13%) in South Gyeongsang.

**Table 12. Speaker differences and accent distributions (disyllabic)**

speaker accent	N1	N2	N3	N4	N5	Totals	Ratio
HH	167	177	157	159	162	822	20%
HL	346	351	369	324	319	1709	41%
LH	275	274	253	260	232	1294	31%
H:H	71	69	61	73	37	311	8%
Totals	859	871	840	816	750	4136	

## 6.2 Correspondences with MK accent

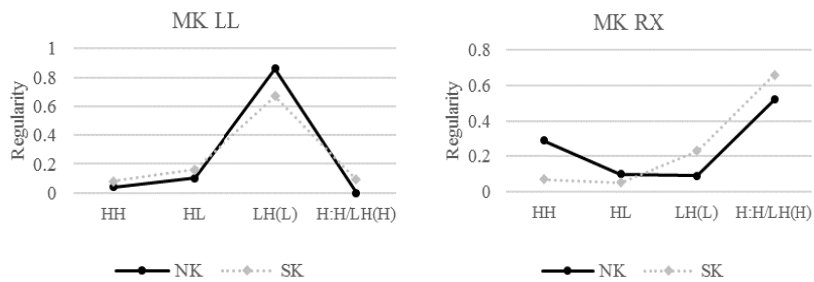
Table 13 shows correspondences between MK and North Gyeongsang accent classes in disyllabic simplex nouns. Shaded cells indicate the regular correspondences. As can be seen, the regular correspondence rate (regularity) is highest in the MK LL class (86%), followed by the MK LH class (77%), the HX class (64%), and the RX class (52%). The hierarchy of regularity in North Gyeongsang is different from that in South Gyeongsang: MK LH (71%) > MK LL (67%), MK RX (66%) > MK HX (56%), as seen in Table 13. Compared to South Gyeongsang, the regularity rate of MK LL in North Gyeongsang is higher (86% vs. 67%), while the regularity rate of MK RX in North Gyeongsang is lower (52% vs. 66%). In addition, irregular changes from MK RX to North Gyeongsang HH are frequently observed (29%), probably due to the merger/loss of a long vowel. In South Gyeongsang, the equivalent change (MK RX > South Gyeongsang HH) is not as frequently observed (7%). Rather, the MK RX class tends to change to the South Gyeongsang LH(L) class irregularly (23%) due to the identical isolation form (LH) between LH(H) and LH(L). In fact, South Gyeongsang speakers tend to confuse the accent patterns of many words between LH(H) and LH(L), suggesting that a near-merger of these two accent classes is in progress (Utsugi 2009). The corresponding change is not frequently observed in North Gyeongsang (MK RX > North Gyeongsang LH, 9%). These differences, as

well as the higher regularity rate of MK LL (= North Gyeongsang LH, South Gyeongsang LH(L)) in North Gyeongsang than in South Gyeongsang, are due to different accentual ambiguities in North and South Gyeongsang: MK HX and RX in North Gyeongsang (= HH and H:H) vs. MK LL and RX in South Gyeongsang (= LH(L) and LH(H)). These differences in patterns between North and South Gyeongsang are shown in Figure 1.

**Table 13. Correspondences between MK and North Gyeongsang (disyllabic; upper: North Gyeongsang, lower: South Gyeongsang)**

MK \ NK	HH	HL	LH	H:H	Totals	HH%	HL%	LH%	H:H %
HX	216	24	62	37	339	64%	7%	18%	11%
LH	51	812	165	30	1058	5%	77%	16%	3%
LL	18	49	432	1	500	4%	10%	86%	0%
RX	60	20	18	106	204	29%	10%	9%	52%

MK \ SK	HH	HL	LH(L)	LH(H)	Totals	HH	HL	LH(L)	LH(H)
HX	166	47	54	27	294	56%	16%	18%	9%
LH	89	779	156	74	1,098	8%	71%	14%	7%
LL	39	76	326	42	483	8%	16%	67%	9%
RX	11	8	37	107	163	7%	5%	23%	66%



**Figure 1. The regularity of the MK LL and RX classes in North and South Gyeongsang**

## (6) Examples of regular correspondences

- a. MK HX: á.kí ‘baby’, tán.cí ‘jar’, kú.rím ‘cloud’, cán.c<sup>h</sup>í ‘party’, sɛŋ.kák ‘thought’  
 b. MK LH: ó.k\*e ‘shoulder’, í.pul ‘bedding’, pá.wi ‘rock’, ká.sim ‘breast’, há.nil ‘sky’  
 c. MK LL: ən.ták ‘hill’, əl.kúl ‘face’, pa.rám ‘wind’, po.rí ‘barley’, ki.túnj ‘pillar’  
 d. MK RX: á.n.ké ‘fog’, í:m.cá ‘master’, pá:ŋ.kwí ‘gas’, kó:.cís ‘lie’, k\*á:.c<sup>h</sup>í ‘magpie’

## 6.3 Token frequency

In parallel to monosyllabic nouns, we investigated the effects of token frequency in disyllabic nouns. Our results were comparable (Table 14): the higher the token frequency, the higher the regular correspondence rates ( $\chi^2 = 104.0499$ ,  $df = 1$ ,  $p < 2.2e-16$ ).

**Table 14. Token frequency and accent (disyllabic lexicon)**

MK \ NK	HH	HL	LH	H:H	Totals	HH%	HL%	LH%	H:H%
HX (Low)	107	13	40	27	187	57%	7%	21%	14%
HX (High)	94	11	17	10	132	71%	8%	13%	8%
LH (Low)	33	283	113	20	449	7%	63%	25%	4%
LH (High)	18	445	33	10	506	4%	88%	7%	2%
LL (Low)	16	20	158	0	194	8%	10%	81%	0%
LL (High)	2	29	277	1	309	1%	9%	90%	0%
RX (Low)	30	10	6	42	88	34%	11%	7%	48%
RX (High)	20	10	2	64	96	21%	10%	2%	67%

## (7) Examples

- a. MK HX (Low): pú.á~pu.á ‘lungs’, mú.swé~mú:.swé ‘iron’, t<sup>h</sup>í.rím~t<sup>h</sup>í.rím ‘belching’  
 b. MK HX (High): jóm.só ‘goat’, cáŋ.sá ‘trade’, t<sup>h</sup>ó.k\*í ‘rabbit’  
 c. MK LH (Low): á.uk~a.úk ‘mallow’, mó.ru~mø.rú ‘wild grapes’, kák.si~kák.sí ‘doll bride’  
 d. MK LH (High): á.til ‘son’, á.ce ‘yesterday’, pá.ta ‘sea’  
 e. MK LL (Low): á.u~a.ú ‘younger brother’, pól.mó ‘mortgage’, kí.ru ‘stump’  
 f. MK LL (High): pu.ák<sup>h</sup> ‘kitchen’, na.mú ‘tree’, to.túk ‘thief’



- g. MK RX (Low) : pák.cwí ‘bat’, pú:.c<sup>h</sup>ú~pú.c<sup>h</sup>ú ‘Korean leek’, tó:.k\*í~tó.k\*í ‘ax’  
 h. MK RX (High) : ó:.rín ‘adult’, sá:.rám ‘man’, kó:.cís ‘lie’

#### 6.4 Initial onset

Table 15 outlines accent class distribution based on onset type of the initial syllable. In this table, words with a fricative onset were excluded, as in monosyllabic nouns. There is no clear association between onset type and accent class in North Gyeongsang (no relationships reach statistical significance). On the other hand, in South Gyeongsang, onset effects are confirmed: aspirated/tense onsets tend to appear with H-initial classes (HH and HL).

**Table 15. Onset type and accent class (disyllabic; upper: North Gyeongsang, lower: South Gyeongsang) [ $\chi^2 = 10.839$ , df = 6, p = 0.09348 for North Gyeongsang;  $\chi^2 = 69.5015$ , df = 6, p = 5.174e-13 for South Gyeongsang]**

onset \ accent	HH	HL	LH	H:H	Totals	HH	HL	LH	H:H
Sonorant	275	558	406	83	1322	1.10	0.99	0.97	0.89
Lax	295	729	558	138	1720	0.91	1.00	1.02	1.14
Asp/Tns	107	238	175	32	552	1.03	1.02	1.00	0.82
Totals	677	1525	1139	253	3594				

onset \ accent	HH	HL	LH(L)	LH(H)	Totals	HH	HL	LH(L)	LH(H)
Sonorant	203	512	356	198	1269	0.93	0.95	0.99	<b>1.29</b>
Lax	289	725	553	191	1758	0.96	0.98	<b>1.11</b>	0.90
Asp/Tns	104	234	80	33	451	<b>1.35</b>	<b>1.23</b>	<b>0.62</b>	<b>0.60</b>
Totals	596	1471	989	422	3478				

#### (8) Examples (North Gyeongsang)

- a. Sonorant: ó.rí ‘duck’, ná.í ‘age’, á.i ‘child’, mó.ri ‘head’, a.c<sup>h</sup>ím ‘morning’, ma.ím ‘mind’, í:.rí ‘wolf’, mú:.táj ‘shaman’  
 b. Lax: pón.ké ‘lightning’, kók.cón ‘anxiety’, pá.ci ‘trousers’, ká.si ‘thorn’, paŋ.á ‘mill’, ka.ci ‘eggplant’, pé:.ké ‘pillow’, ká:.cé ‘crayfish’  
 c. Aspirated/Tense: s\*íl.ké ‘gallbladder’, t<sup>h</sup>ó.k\*í ‘rabbit’, t\*ák.ci ‘scab’, p<sup>h</sup>én.i ‘top’, k\*u.cún ‘scolding’, t<sup>h</sup>u.cón ‘grumbling’, k\*á:.c<sup>h</sup>í ‘magpie’, t<sup>h</sup>á:.pák~t<sup>h</sup>á.pák ‘faultfinding’

## 6.5 Weight effects

Table 16 shows correlations between syllable weight structure and accent class in disyllabic nouns. In this paper, a long vowel that appears in the H:H class is assumed to be a suprasegmental feature; hence, a (C)V: syllable is classified as a light (= open) syllable. HH is overrepresented in initial-heavy, while HL is underrepresented. As noted by Do et al. (2014), this is considered to be an accident of historical development: Gyeongsang HH corresponds with MK HX, whereas Gyeongsang HL corresponds with MK LH; an initial heavy syllable would constitute the most favorable circumstance for the pitch peak to be attracted away from the right edge of the word (LH), which was a default accent class in MK, as mentioned above (Section 3). Final heavy syllables are associated with the LH class, while LH is underrepresented in final light syllables. Similar association patterns are observed in South Gyeongsang, although LH(H) and LH(L) are aggregated in Do et al.'s (2014) study.

**Table 16. Syllable weight and accent class (disyllabic) [ $\chi^2 = 294.7206$ ,  $df = 9$ ,  $p < 2.2e-16$ ]**

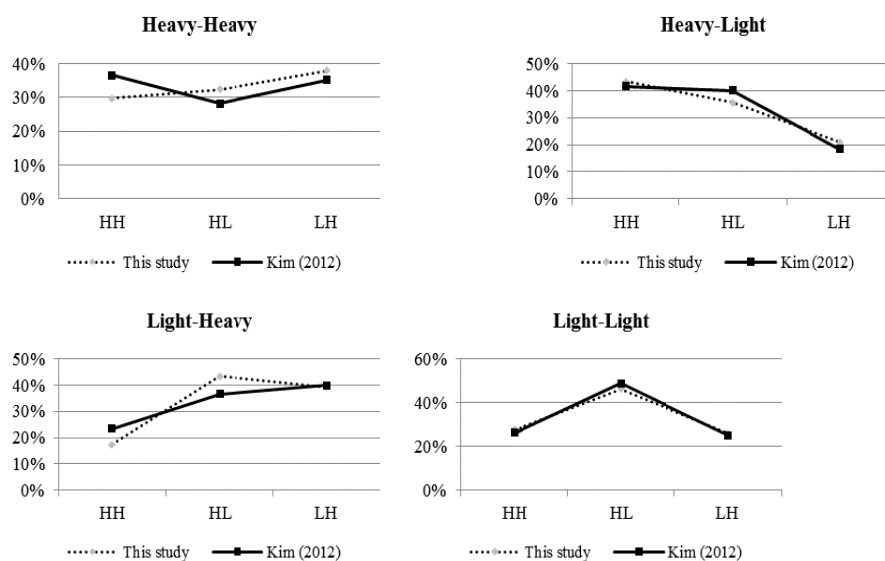
weight \ accent	HH	HL	LH	H:H	Totals	HH	HL	LH	H:H
Heavy-Heavy	130	167	196	24	517	<b>1.27</b>	<b>0.78</b>	<b>1.21</b>	<b>0.62</b>
Heavy-Light	293	295	172	66	826	<b>1.79</b>	<b>0.86</b>	<b>0.67</b>	1.06
Light-Heavy	175	649	588	85	1497	<b>0.59</b>	1.05	<b>1.26</b>	<b>0.75</b>
Light-Light	223	598	338	136	1295	<b>0.87</b>	<b>1.12</b>	<b>0.83</b>	<b>1.40</b>
Totals	821	1709	1294	311	4135				

## (9) Examples

- Heavy-Heavy: ík.sál ‘drollery’, káp.cól ‘double’, páŋ.ul ‘bell’, k\*óp.cil ‘peel’, aŋ.kím ‘dregs’, ən.tók ‘hill’, í:m.kím ‘king’, kú:l.t\*úk~kúl.t\*úk ‘chimney’
- Heavy-Light: ák.cí ‘stubbornness’, ník.té ‘wolf’, pól.le ‘insect’, tón.mu ‘friend’, jəl.mé ‘fruit’, tan.c<sup>h</sup>ú ‘button’, á:n.ké ‘fog’, í:m.cá ‘master’
- Light-Heavy: pé.ún ‘send-off’, kí.mím ‘the last day of the month’, ú.mul ‘well’, pá.nil ‘needle’, jə.múl ‘chaff’, pa.k\*át<sup>h</sup> ‘outside’, mú:.tán ‘shaman’, sá:.rám ‘man’
- Light-Light: á.ká ‘baby’, só.mé ‘sleeve’, á.ne ‘wife’, pí.nu ‘soap’, jə.ú ‘fox’, pi.njó ‘hairpin’, pá:.pó ‘fool’, té:.p<sup>h</sup>é ‘plane’

Vowel length is not distinguished in H-J. Kim (2012). When we aggregate the H:H class in our corpus of the existing lexicon with the HH class, the correlations between

syllable weight structure and accent class in disyllabic and trisyllabic data are similar to those reported by H-J. Kim (2012: 42, 46). However, the data in H-J. Kim (2012) seems to show more weight-sensitive patterns. For example, as seen in Figure 2, the ratio of the HH class in Heavy-Heavy structure is much higher in H-J. Kim (2012) than in the present study, and the ratio of the HL class in Heavy-Light structure is higher in H-J. Kim (2012) than in the present study. On the other hand, the ratio of the HL class in Light-Heavy structure is higher in the present study than in H-J. Kim (2012). This discordance may suggest that the subjects of our study are more conservative and retain regular accent patterns corresponding to the MK accent, while the subjects in H-J. Kim (2012) show more innovations that are affected by syllable weight. However, since detailed information about the subjects interviewed in H-J. Kim (2012) is not known, the reasons for these differences remain unclear.



**Figure 2. Comparisons of weight-tone correlations in disyllabic nouns between the present study and H-J. Kim (2012)**

## 6.6 Summary

For the disyllabic data mentioned above, we again fitted a mixed-effects log-linear regression model using the `glmer` function in R with subject and item as random factors. For simplicity, we examined onset type (aspirated/tense vs. lax/sonorant) in the initial syllable and weight effects (heavy vs. light) in the penultimate and final syllables as predictor variables. The distribution of accent classes (HH, HL, LH, H:H) with regard to these factors was the dependent variable. The base line was set to HL, lax/sonorant onset, and light syllables. As seen in Table 17, onset types were not significantly related to other factors in any accent classes. On the other hand, a penultimate heavy syllable was positively associated with the HH class, whereas a final heavy syllable was positively associated with the LH class. A final heavy syllable was negatively associated with the HH and H:H accent classes. Thus, unlike in South Gyeongsang, only a syllable weight effect is confirmed in North Gyeongsang.

**Table 17. Results of a mixed-effects log-linear regression model (disyllabic lexicon)**

		Estimate	Std. Error	z value	Pr(> z )
(Intercept)		-2.2172	0.04232	-52.4	< 2e-16 ***
HH class:	Ons-Asp/Tns	0.01498	0.12681	0.12	0.906
	Penult-Heavy	1.04781	0.09599	10.92	< 2e-16 ***
	Final-Heavy	-0.49651	0.09493	-5.23	1.69e-07 ***
LH class:	Ons-Asp/Tns	-0.01747	0.10832	-0.16	0.872
	Penult-Heavy	0.12916	0.08647	1.49	0.135
	Final-Heavy	0.50355	0.07946	6.34	2.34e-10 ***
H:H class:	Ons-Asp/Tns	-0.2401	0.20194	-1.19	0.234
	Penult-Heavy	0.07703	0.15028	0.51	0.608
	Final-Heavy	-0.89125	0.1497	-5.95	2.62e-09 ***

## 7. Trisyllabic nouns

### 7.1 Distributions

In this section, we investigate the accent distribution patterns of trisyllabic simplex

nouns. Table 18 summarizes the accent class distribution for each speaker. Again, N5 shows the lowest ratio of the H:HL class (4%), reflecting the on-going loss of the vowel length distinction. In both North and South Gyeongsang, the LHL class is by far the most frequent (75% in North Gyeongsang, 78% in South Gyeongsang). HLL is the least frequent class in both dialects, probably due to the \*Lapse-Right constraint that penalizes a candidate with two successive syllables without H at the right edge of the word.

**Table 18. Accent class distribution (trisyllabic; upper: North Gyeongsang, lower: South Gyeongsang)**

speaker accent	N1	N2	N3	N4	N5	Totals	Ratio
HHL	35	43	52	20	30	180	9%
HLL	18	19	17	12	10	76	4%
LHL	319	324	327	291	277	1,538	75%
LLH	28	29	35	25	24	141	7%
H:HL	33	23	24	29	15	124	6%
Totals	433	438	455	377	356	2,059	

speaker accent	YD	CP	MA	KM	YJ	Totals	Ratio
HHL	25	19	11	9	17	81	5%
HLL	14	8	14	6	8	50	3%
LHL	260	235	244	249	198	1,186	78%
LHH	43	40	56	35	35	209	14%
Totals	342	302	325	299	258	1,526	

The ratio of HHL is slightly higher in North Gyeongsang compared to South Gyeongsang (9% vs. 5%), and it is even higher than LLH in North Gyeongsang (7%). In South Gyeongsang, the final accent (LHH) class is larger than LLH in North Gyeongsang (14% in South Gyeongsang vs. 7% in North Gyeongsang). These differences are due to differences in mergers of accent classes in the two dialects: the near-merger of MK HXX and RXX to North Gyeongsang HHL by the loss of the long vowel vs. the merger of the MK LLL and RXX to South Gyeongsang LHH by leftward spreading of H. If H:HL is aggregated to HHL in North Gyeongsang, then the ratio of HHL reaches 15%. This observation suggests that two accent classes are

becoming predominant in North and South Gyeongsang, HHL and LHL in North Gyeongsang and LHH and LHL in South Gyeongsang.

## 7.2 Correspondences with MK

Table 19 shows the historical correspondences between MK and North Gyeongsang. Shaded cells represent regular correspondences. The regularity rates are high in MK LLH (97%) and LLL (100%). Many words irregularly moved to LHL, based on its highest type frequency. North and South Gyeongsang show similar tendencies, except for the relatively high rate of an irregular change from MK RXX to HHL in North Gyeongsang (12%) vs. a lower rate of the same change in South Gyeongsang (5%). The higher ratio of this change in North Gyeongsang is due to the loss of the length distinction.

**Table 19. Correspondences between MK and North Gyeongsang (trisyllabic)**

MK \ NK	HHL	HLL	LHL	LLH	H:HL	Totals	HHL%	HLL%	LHL%	LLH%	H:HL%
HXX	14	0	76	6	6	102	14%	0%	75%	6%	6%
LHX	7	52	103	1	9	172	4%	30%	60%	1%	5%
LLH	7	0	248	0	1	256	3%	0%	97%	0%	0%
LLL	0	0	0	23	0	23	0%	0%	0%	100%	0%
RXX	6	0	12	0	33	51	12%	0%	24%	0%	65%

### (10) Examples of regular correspondences

- MK HXX: hál.mó.ni~hal.mó.ni ‘grandmother’, mú.cí.ke~mú:cí.ke ‘rainbow’, ó.ré.pi~o.ré.pi ‘girl’s elder brother’
- MK LHX: á.hi.re ‘nine days’, jǒ.ti.re ‘eight days’, ká.mul.c<sup>hi</sup> ‘snake-headed fish’
- MK LLH: pa.kú.ni ‘basket’, pən.té.ki ‘chrysalis’, tu.k\*á.pi ‘toad’
- MK LLL: pok.suŋ.á ‘peach’, pu.sí.róm ‘ulcer’, k\*u.ci.rám ‘scolding’
- MK RXX: kó:.mó.ri ‘leech’, kí:.cí.ke~ki.cí.ke ‘stretching’, má:.nú.ra ‘wife’

## 7.3 Weight effects

Table 20 shows the correlation between syllable weight and accent class. A final-heavy syllable is associated with the final accent class (LLH), which is a tendency also observed in South Gyeongsang. On the other hand, an initial-heavy syllable

seems to appear relatively frequently with HHL in North Gyeongsang, but not in South Gyeongsang (4-8%).

**Table 20. Syllable weight and accent class (trisyllabic)**

weight \ accent	HHL	HLL	LHL	LLH	H:HL	Totals	HHL	HLL	LHL	LLH	H:HL
Heavy-Heavy-Light	50	10	153	18	6	237	21%	4%	65%	8%	3%
Heavy-Light-Heavy	5		3	5	2	15	33%	0%	20%	33%	13%
Heavy-Light-Light	49		483	1	6	539	9%	0%	90%	0%	1%
Light-Heavy-Heavy			1	8		9	0%	0%	11%	89%	0%
Light-Heavy-Light	25	4	162		16	207	12%	2%	78%	0%	8%
Light-Light-Heavy	12	2	29	80	13	136	9%	1%	21%	59%	10%
Light-Light-Light	39	60	707	29	81	916	4%	7%	77%	3%	9%
Totals	180	76	1538	141	124	2059					

(11) Examples

- Heavy-Heavy-Light: óŋ.tón.i ‘buttocks’, úŋ.tón.i~úŋ.tón.i ‘puddle’, sal.k<sup>h</sup>wén.i ‘wildcat’, pok.suŋ.á ‘peach’, kú:m.pén.i~kúm.pén.i ‘maggot’
- Heavy-Light-Heavy: mál.mí.cal~mal.mí.cal ‘sea anemone’, wal.ka.ták ‘tomboy’, sí:m.pú.rim~sím.pú.rim ‘errand’
- Heavy-Light-Light: hál.mó.ni~hal.mó.ni ‘grandmother’, pjəŋ.á.ri ‘chick’, hoŋ.tú.k\*é~hoŋ.tu.k\*é ‘wooden roller used in smoothing cloth’, wó:n.sí.i~wən.sí.i ‘monkey’
- Light-Heavy-Heavy: mu.ríp.p<sup>h</sup>ak ‘knee’, to.roŋ.njón ‘salamander’
- Light-Heavy-Light: hó.pák.ci ‘the fleshy inside of the thigh’, ká.mul.c<sup>h</sup>i ‘snake-headed fish’, a.cúm.ma ‘aunty’, hó:.ráŋ.i~hó.ráŋ.i ‘tiger’
- Light-Light-Heavy: hwí.p<sup>h</sup>á.ram~hwi.p<sup>h</sup>a.rám ‘whistle’, í.ti.rim ‘pimple’, k\*í.ná.p<sup>h</sup>ul~k\*í.ná.p<sup>h</sup>ul ‘a piece of string’, o.ri.mák ‘uprise’, ó:.rí.sin~ó.rí.sin ‘esteemed elder’
- Light-Light-Light: í.já.ki~i.já.ki ‘conversation’, á.hi.re ‘nine days’, a.pó.ci ‘father’, ka.si.ná ‘woman’, kó:.mó.ri ‘leech’

As seen in Table 21, initial heavy syllables are overrepresented in the HHL class, but underrepresented in the HLL class. However, initial light syllables are underrepresented in HHL vs. overrepresented in HLL. Thus, in North Gyeongsang, an arbitrary association between an initial heavy syllable and the double-H class is observed in both disyllabic and trisyllabic nouns. This association is considered to originate from MK,

where the Gyeongsang HHL and HLL classes correspond with HXX and LHX, and an initial-heavy syllable was probably associated with the HXX class.

**Table 21. Syllable weight and accent class (trisyllabic, aggregated). X = any syllable weight. [ $\chi^2 = 121.237$ ,  $df = 4$ ,  $p < 2.2e-16$ ]**

weight \ accent	HHL	HLL	LHL	LLH	H:HL	Totals	HHL	HLL	LHL	LLH	H:HL
Heavy-X-X	104	10	639	24	14	791	<b>1.50</b>	<b>0.34</b>	1.08	<b>0.44</b>	<b>0.29</b>
Light-X-X	76	66	899	117	110	1268	<b>0.69</b>	<b>1.41</b>	0.95	<b>1.35</b>	<b>1.44</b>
Totals	180	76	1538	141	124	2059					

#### 7.4 Onset effects

Here, we examine the onset effects of both initial and pen-initial syllables in North Gyeongsang trisyllabic nouns. Table 22 shows the correlation between the initial onset type and accent class. Sonorant onsets are overrepresented in the H-initial classes (HHL and HLL), while aspirated/tense onsets are underrepresented in the same classes. Thus, there are no phonetically natural associations that can be understood in a straightforward manner for North Gyeongsang trisyllabic nouns. On the other hand, in South Gyeongsang, aspirated/tense onsets are overrepresented in HHL (1.78), as seen in Table 22.

**Table 22. Onset type and accent class (trisyllabic, initial; upper: North Gyeongsang, lower: South Gyeongsang) [ $\chi^2 = 101.7606$ ,  $df = 8$ ,  $p < 2.2e-16$  for North Gyeongsang;  $\chi^2 = 69.5027$ ,  $df = 6$ ,  $p = 5.171e-13$  for South Gyeongsang]**

onset \ accent	HHL	HLL	LHL	LLH	H:HL	Totals	HHL	HLL	LHL	LLH	H:HL
Sonorant	71	47	426	43	30	617	<b>1.47</b>	<b>1.88</b>	<b>0.90</b>	1.04	1.11
Lax	56	20	558	68	42	744	0.96	0.66	0.97	<b>1.36</b>	1.29
Asp/Tns	14	6	404	10	7	441	<b>0.41</b>	<b>0.34</b>	<b>1.19</b>	<b>0.34</b>	<b>0.36</b>
Totals	141	73	1388	121	79	1802					

onset \ accent	HHL	HLL	LHL	LHH	Totals	HHL	HLL	LHL	LHH
Sonorant	26	32	325	71	454	1.20	<b>1.96</b>	0.91	1.22
Lax	15	14	503	94	626	<b>0.50</b>	0.62	1.02	1.17
Asp/Tns	24	3	246	10	283	<b>1.78</b>	<b>0.29</b>	1.10	<b>0.28</b>
Totals	65	49	1,074	175	1,363				



## (12) Examples (North Gyeongsang)

- a. Sonorant: mɛŋ.k\*óŋ.i ‘a kind of frog’, mjó.nu.ri ‘daughter-in-law’, ma.mú.ri ‘finish’, min.til.lé ‘dandelion’, má:.nú.ra ‘wife’
- b. Lax: kí.rím.ca ‘shadow’, ká.mul.c<sup>h</sup>i ‘snake-headed fish’, tal.p<sup>h</sup>éŋ.i ‘snail’, cin.tal.lé ‘azalea’, cí:.róŋ.i~cí.róŋ.i ‘earthworm’
- c. Aspirated/Tense: t\*í.né.ki~t\*í.né.ki ‘wanderer’, t\*úŋ.t\*an.ci ‘blunt person’, k<sup>h</sup>o.k\*í.ri ‘elephant’, k\*u.ci.rám ‘scolding’, k\*wá:.pé.ki~k\*wá.pé.ki ‘cruller’

Table 23 shows the correlation between pen-initial onset type and accent class. No clear association patterns are observed. The same is true for South Gyeongsang.

**Table 23. Onset type and accent class (trisyllabic, pen-initial) [ $\chi^2 = 31.6224$ ,  $df = 8$ ,  $p = 0.0001088$ ]**

onset \ accent	HHL	HLL	LHL	LLH	H:HL	Totals	HHL	HLL	LHL	LLH	H:HL
Sonorant	49	31	504	26	58	668	0.83	1.27	1.00	0.70	<b>1.41</b>
Lax	94	23	710	68	41	936	1.13	0.67	1.00	<b>1.30</b>	<b>0.71</b>
Asp/Tns	27	16	241	13	19	316	0.97	1.39	1.01	0.74	0.98
Totals	170	70	1455	107	118	1920					

## (13) Examples

- a. Sonorant: hál.mó.ni~hal.mó.ni ‘grandmother’, ká.o.ri~ka.ó.ri ‘ray’, ta.rí.mi ‘iron’, o.ri.mák ‘uprise’, kó:.má.ri ‘leech’
- b. Lax: kúŋ.túŋ.i ‘buttocks’, á.ci.mɛ ‘aunt’, a.ká.mi ‘gills’, pu.ci.rón ‘diligence’, kó:.kú.ma~kó.kú.ma ‘sweet potato’
- c. Aspirated/Tense: hwí.p<sup>h</sup>á.ram~hwi.p<sup>h</sup>a.rám ‘whistle’, t\*úŋ.t\*an.ci ‘blunt person’, ol.p\*é.mi ‘owl’, pu.t\*u.mák ‘cooking fireplace’, sá:.t<sup>h</sup>ú.ri ‘dialect’

## 7.5 Summary

We fitted a mixed-effects log-linear regression model to the trisyllabic data discussed in this section, using the glmer function in R with subject and item as random factors. The predictor variables were onset types (aspirated/tense vs. lax/sonorant) in the initial and penultimate syllables and syllable weight (heavy vs. light) in the antepenultimate, penultimate, and final syllables. The distribution of accent class

(HHL, HLL, LLH, H:HL) with regard to this factor was the dependent variable. The base line was set to LHL, lax/sonorant onset, and light syllable. As Table 24 shows, initial aspirated/tense onsets are negatively associated with all accent classes, reflecting overrepresentation of only the LHL accent class with these onset types. The presence of a final heavy syllable is biased to the HHL, LLH, and H:HL classes. Notable differences from South Gyeongsang are the absence of the positive association between initial aspirated/tense onsets and the HHL class and an arbitrary positive association between antepenultimate heavy syllables and the HHL accent.

**Table 24. Results of a mixed-effects log-linear regression model (trisyllabic lexicon)**

	Estimate	Std. Error	z value	Pr(> z )	
(Intercept)	-1.88565	0.05552	-33.96	< 2e-16	***
HHL: Initial Ons-Asp/Tns	-1.47977	0.30804	-4.80	1.56e-06	***
Penult Ons-Asp/Tns	0.08958	0.23664	0.38	0.705008	
Antepenult-Heavy	0.66681	0.18123	3.68	0.000234	***
Penult-Heavy	1.21745	0.18310	6.65	2.95e-11	***
Final-Heavy	1.23883	0.42065	2.95	0.003229	**
HLL: Initial Ons-Asp/Tns	-1.43961	0.43218	-3.33	0.000865	***
Penult Ons-Asp/Tns	0.23243	0.31795	0.73	0.464767	
Antepenult-Heavy	-1.43734	0.34739	-4.14	3.51e-05	***
Penult-Heavy	0.01588	0.30813	0.05	0.958899	
Final-Heavy	0.55332	0.74822	0.74	0.459594	
LLH: Initial Ons-Asp/Tns	-1.17458	0.34133	-3.44	0.000579	***
Penult Ons-Asp/Tns	-1.15294	0.46662	-2.47	0.013481	*
Antepenult-Heavy	-1.05497	0.27011	-3.91	9.39e-05	***
Penult-Heavy	-0.15698	0.28466	-0.55	0.581321	
Final-Heavy	5.25847	0.33014	15.93	< 2e-16	***
H:HL: Initial Ons-Asp/Tns	-1.39412	0.40158	-3.47	0.000517	***
Penult Ons-Asp/Tns	-0.61714	0.40402	-1.53	0.126637	
Antepenult-Heavy	-1.82209	0.37824	-4.82	1.46e-06	***
Penult-Heavy	-0.52476	0.34647	-1.51	0.129877	
Final-Heavy	2.27359	0.38837	5.85	4.79e-09	***

## 8. Summary of lexical distributions in North and South Gyeongsang

Table 25 summarizes the discussions in Sections 5-7. When different patterns are observed between North and South Gyeongsang, they are reported separately. The shared patterns between the two dialects are shaded.

**Table 25. Comparison between North Gyeongsang (NK) and South Gyeongsang (SK)**

	Monosyllabic	Disyllabic	Trisyllabic
Major accent	H(H)	HL	LHL
Dispreferred accent	MK R (= NK H:(H)/SK L(H))	MK RX (= NK H:H/SK LH(H))	NK: H:HL/HLL SK: HHL/HLL
Tonal merger	NK: H:(H) > H(H) SK: not confirmed	NK: H:H > HH SK: LH(H) > LH(L)	NK: H:HL > HHL SK: MK LLL > MK RXX (= both LHH in SK)
Regular correspondences with MK	MK H > L > R	MK LH and LL are most regular	MK LLH and LLL are most regular
Coda effect/ weight effect	sonorant coda ≈ MK R (= NK H:(H)/SK L(H))	Penult-Heavy ≈ HH Final-Heavy ≈ final accent	NK: Antepenult-Heavy ≈ HHL, Final-Heavy ≈ final accent SK: Final-Heavy ≈ final accent
Onset effect	aspirated/tense onsets ≈ H(H)	NK: no clear association SK: aspirated/tense onsets ≈ H-initial classes	NK: no clear association SK: aspirated/tense onsets ≈ HHL

For monosyllabic nouns, the major accent class is H(H) in both dialects. Both disprefer the MK R class (= North Gyeongsang H:(H), South Gyeongsang L(H)), which was the smallest class in MK with a marked structure. A near-tonal merger (H:(H) > H(H)) is only observed in NK due to the loss of the length distinction. The regularity rate in the correspondence with MK is highest in the MK H class, followed by L and R in both North and South Gyeongsang. A sonorant coda is associated with

the MK R class (= North Gyeongsang H:(H), South Gyeongsang L(H)), reflecting the original rising tone in MK. Finally, an onset effect is observed in both dialects, in that aspirated/tense onsets are overrepresented in H(H).

In disyllabic nouns, the major accent class is HL in both dialects; as in monosyllabic nouns, both dialects disprefer the MK R-initial class (= North Gyeongsang H:H/South Gyeongsang LH(H)). A near-tonal merger is observed in both North and South Gyeongsang, but the accent classes involved are different: H:H > HH in North Gyeongsang vs. LH(H) > LH(L) in South Gyeongsang. The regularity rate in the correspondence with MK is high in the MK LH and LL classes (= the Gyeongsang penultimate and final accent classes). An initial-heavy syllable is associated with the HH class in both dialects, which is a residue of the original association observed in MK. A final-heavy syllable is also associated with the final accent class in both dialects. There was no clear onset-tone correlation in North Gyeongsang, whereas initial-aspirated/tense onsets are overrepresented in the H-initial classes (= HH and HL) in South Gyeongsang.

Among trisyllabic nouns, LHL is by far the largest class in both North and South Gyeongsang. Both dialects disprefer HLL due to a \*Lapse-Right constraint. The second dispreferred accent class is different between the two: H:HL in North Gyeongsang vs. HHL in South Gyeongsang. A near-tonal merger from H:HL to HHL is observed in North Gyeongsang, whereas a tonal merger has been completed in South Gyeongsang in that the MK LLL class merged with MK RXX class (= the South Gyeongsang LHH class) by a leftward spreading of an H tone. The MK LLH and LLL classes are most regular in the correspondence with MK. Irregular changes from MK RXX to HHL are relatively frequent in North Gyeongsang due to the near-merger mentioned above. In both North and South Gyeongsang, final-heavy syllables are associated with the final accent class, while antepenultimate heavy syllables are associated with HHL only in North Gyeongsang. On the other hand, onset-tone association is only observed in South Gyeongsang where initial-aspirated/tense onsets tend to appear with HHL. North Gyeongsang does not show such a tendency.

Thus, in general, North and South Gyeongsang show similar tendencies in terms of accent distributional patterns, but demonstrate discrepancies based on differences in the ambiguities/mergers of accent classes. In South Gyeongsang, an association between aspirated/tense onsets and the double-H class is consistently observed regardless of the syllable number of the stem, whereas it is only confirmed in monosyllabic nouns in North Gyeongsang.

Regarding the association between aspirated/tense onset and double-H accent, one possible explanation comes from the origin of aspirated/tense onsets in Korean and their associations with a certain accent class, as well as differences in tonal mergers in the two dialects. According to reconstructions by Ramsey (1978, 1986, 1991, 2001), Proto-Korean did not have a contrastive accent, and a default final accent was assigned for each stem. Tense consonants in contemporary Korean are documented as consonant clusters in MK texts. Both aspirated consonants and consonant clusters typically result from weak vowel syncope in the initial syllable, leading to a strong correlation between these onset types and a H tone:  $*C_1\lambda.C_2\acute{V} > C_1C_2\acute{V}$  (if  $C_1$  or  $C_2$  was /k/, then the resulting cluster changed to an aspirated consonant). In fact, aspirated/cluster onsets were overrepresented in the MK H/HX classes, as shown in Table 26 below<sup>7</sup>. On the other hand, aspirated/cluster onsets dispreferred the R-initial classes: there are only three nouns with these onsets that belonged to the R-initial classes in MK.

**Table 26. Correlations between onset type and accent in MK based on the data in Ito (2013) (upper: monosyllabic, lower: disyllabic). [ $\chi^2 = 39.8142$ ,  $df = 2$ ,  $p = 2.262e-09$  for monosyllabic;  $\chi^2 = 23.1703$ ,  $df = 3$ ,  $p = 3.721e-05$  for disyllabic]**

onset \ accent	H	L	R	Totals	H	L	R
C	199	113	88	400	0.88	1.09	1.25
C <sup>h</sup> /CC	87	19	1	107	<b>1.44</b>	0.68	<b>0.05</b>
Totals	286	132	89	507			

onset \ accent	HX	LH	LL	RX	Totals	HX	LH	LL	RX
C	80	399	192	53	724	0.88	1.02	1.00	1.03
C <sup>h</sup> /CC	17	18	14	2	51	<b>2.66</b>	0.66	1.03	0.55
Totals	97	417	206	55	775				

In North Gyeongsang, the MK H and R classes and the HX and RX classes correspond with H(H) and H:(H) and with HH and H:H, respectively, and they are in a state of near-merger. This means that two original associations that were in near-complementary distributions (i.e.,  $H \approx$  aspirated/cluster,  $R \neq$  aspirate/cluster) are

<sup>7</sup> Given that a default final accent was assigned for each stem in Proto-Korean, two-syllable nouns with an aspirated/consonant cluster onset and HX accent are reconstructed as a monosyllabic stem  $*C\lambda/i.C\acute{V}$  + a derivative suffix such as a diminutive suffix  $-i$ .

merging, obscuring these associations. On the other hand, in South Gyeongsang, the potential merger of tonal classes is between MK LL and RX (= South Gyeongsang LH(L) and LH(H)) and thus does not weaken the original association between MK HX (= South Gyeongsang HH) and aspirated/cluster onsets. Based on these differences, the association between the double-H tone and aspirated/cluster onsets is retained and even expanded in South Gyeongsang, whereas it has been essentially eliminated in North Gyeongsang.

Do et al. (2014) discussed the origin of the association between aspirated/tense onsets and HH tone in South Gyeongsang and hypothesized that it might be based at least in part on their South Gyeongsang subjects' knowledge of the Standard Seoul Korean dialect where at the beginning of an accentual phrase, the LH boundary tone characterizing the initial rise is replaced by HH when the phrase begins with a laryngeally marked onset (S-A. Jun 1993). However, given that the same association is not observed in North Gyeongsang, we propose that the association between aspirated/tense onsets and HH tone, which was strongly observed in particular in South Gyeongsang nonce words, is probably generalized from the lexicon, where the original association in MK has been retained. We further hypothesize here that the so-called tonogenesis in the Seoul dialect discussed by M-R. Kim et al. (2002), Silva (2006) and many others since may actually have occurred as a generalization/extension of the original onset-tone association in MK: aspirated/tense onsets  $\approx$  initial H vs. lax/sonorant onsets  $\approx$  initial L.

On the other hand, in North Gyeongsang, it is expected that disyllabic novel words with a C<sup>h</sup>V.CV structure should not necessarily prefer double-H accent compared to those with a CV.CV structure, since such an association is not considered to be phonetically natural. In fact, a novel word experiment conducted by H-J. Kim (2012: 136) showed that the distributional patterns of novel words with C<sup>h</sup>V.CV structure were not statistically different from those with CV.CV structure.

In sum, this study not only confirmed similarities between North and South Gyeongsang but also clarified statistical tendencies that systematically differ between the two dialects. This was possible since these dialects share essentially the same base structure and origin, and their detailed comparison enabled us to exemplify how slight changes in a phonological system can lead to different statistical generalizations.

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